WE CLAIM

1. A method for contactless or touch-free measurement of a tool or accessories by means of at least one imaging area means (4,5) and calculation indicating the position and/or orientation of the tool making use of image points on the imaging area means, based on the image points having predetermined mutual positions provided on the tool, imaged onto the imaging area means, and optics presenting the image points on the tool on the imaging area means, the image points being at least three visible within the field of view of the imaging area means and at least one being distinctly identifiable, **characterized** by, in order to measure the position and/or orientation of the tool, providing a number of measuring elements (8,9;13 to 16;20 to 23;26 to 28) on the tool, each measuring element having a size large enough for making a reconstruction of its form and calculation of at least one image point on the tool related to the measuring element even though a part of it happens to be obscured by some obscuring object, for example dust.

2. Method according to claim 1, **characterized** in that at least some of the measuring elements, called lined measuring elements, are positioned on at least one row; and that for each row at least one 3D line going through the lined measuring elements for the row in question is determined.

3. Method according to claim 1 ~~or 2,~~ **characterized** in that consecutive measurements of the measuring elements are provided, each measurement resulting in calculation of the 3D position and/or 3D orientation of the tool, and further calculations are performed to calculate the 3D movements of the tool from calculation to calculation and thereby to calculate at least one type of movement of the tool, such as shift, rotation etc.

4. Method according to ~~any of the preceding claims,~~ claim 1 **characterized** in that most of the measuring elements are markers having the same shape, for instance circular, and that

at least one of the markers has a shape different from the others, for instance a square, a triangle, a diamond or the like, clearly distinguishable in the imaging area means, each said differently shaped marker having a predetermined known position on the tool and determining a reference point for determining shift position, and that a point or points on each marker are calculated to be used as the measuring point or points representing the marker.

5. Method according to claim 4, **characterized** in that, in order to have a uniquely determined position for each differently shaped marker, the differently shaped markers having relation to different rows have a different order and/or different configurations.

6. Method according to ~~any of the preceding claims~~, **characterized** in that for each measuring element or marker its point of balance is detected and is used as a point representing the measured measuring element.

7. Method according to ~~any of the preceding claims,~~ **characterized** in that at least two rows of markers are provided on the tool, and that a line going through each row and/or the position of at least one measuring element point on each row are determined.

8. Method according to claim 7, **characterized** in that the rows of markers are parallel, the rows being either horizontal or vertical.

9. Method according to ~~any of claims 3 to 6 and claim 7 or 8,~~ **characterized** in that roll of the tool is derived by combining the information regarding at least two of the rows.

10. Device for contactless or touch-free measurement of a tool by means of imaging area means (4,5) and processing means (30) making calculations based on image points on the tool, imaged onto the imaging area means, and optics (41, 42;51,52) presenting

the image of the image points on the tool on the imaging area means, the processing means (30) being adapted to calculate the momentary position and/or orientation along at least one axis of the tool making use of the image points,

characterized by

a number of measuring elements and/or markers (8,9;13-16;20-23;26-28) having predetermined mutual positions and being provided on the tool, each measuring element and/or marker comprising at least one measuring point, and at least one of them being identifiable; each measuring element and/or marker to be used as position and/or orientation indicating means having a size making it restorable by the processing means even if a part of it on the tool is obscured for the image area means, for example by dust.

11. Device according to claim 10, **characterized** in that at least some of the measuring elements and/or markers, called lined measuring elements, are positioned on at least one row; and that for each row the processing means (30) determines at least one 3D line going through the lined measuring elements for the row in question and/or the equation of a least one line going through the measuring elements or markers provided in the same row.

12. Device according to claim 10 ~~or 11~~, **characterized** in that there are at least two rows of measuring elements or markers; and that the processing means (30) is adapted to make calculations of a line through each row and/or the position of at least one measuring element or marker on each row.

13. Device according to claim 12, **characterized** in that the rows are parallel to each other, either horizontally or vertically.

14. Device according to claim 12, **characterized** in that the rows of markers extend along a line going from one end side of the tool to the other and are angled in relation to each other.

claim 10

15. Device according to ~~any of the claims 10 to 14,~~ **characterized** in that the processing means (30) is adapted to make consecutive measurements to the measuring elements, each measurement resulting in the calculation of at least a line of the tool surface in space, and the processing means (30) is adapted to calculate movements of the tool in space between calculations and thereby to calculate at least one type of movement of the tool, such as shift, rotation etc.

claim 10

16. Device according to ~~any of the claims 10 to 15,~~ **characterized** in that at least most of the markers (8;13;20) on the tool have the same shape, for instance circular, and that at least one marker (9;14 to 16) is provided having a shape different from the others, for instance a square, triangle, diamond or the like, clearly distinguishable in the imaging area(s), each said differently shaped marker having a predetermined known position on the tool and in relation to a predetermined constellation of the others.

17. Device according to claim 16, **characterized** in that in that most of the measuring elements are positioned in at least one row, and that, in order to have a uniquely determinable position for each differently shaped marker, the markers having positions related to different rows have a different order and/or different configurations.

claim 10

18. Device according to ~~any of the claims 10 to 17,~~ **characterized** in that each measuring element provided in a row of measuring elements used for the measurement is a part of a marker having a two-dimensional shape.

claim 10

19. Device according to ~~any of the claims 10 to 17,~~ **characterized** in that the processing means (30) detects the point of balance in a marker and uses it as one of the measuring points.

claim 10

20. Device according to ~~any of the claims 10 to 19~~, **characterized** in that the processing means (30) calculates shift of the tool by detecting different spatial

positions of the differently shaped marker or markers in the consecutively made measurements.

A 21. Device according to ~~any of the claims 10 to 20;~~ claim 10 **characterized** in that the markers (8,9;13-15;20-23) are reflective and provided on a dull background, and by lighting units (6,7) illuminating the markers at least during the imaging of the imaging areas (4,5).